

and installed to ensure that the operation and operational capabilities of the systems to perform these functions are not adversely affected when the airplane is exposed to lightning.

(b) For functions whose failure would contribute to or cause a condition that would reduce the capability of the airplane or the ability of the flightcrew to cope with adverse operating conditions, each electrical and electronic system that performs these functions must be designed and installed to ensure that these functions can be recovered in a timely manner after the airplane is exposed to lightning.

(c) Compliance with the lightning protection criteria prescribed in paragraphs (a) and (b) of this section must be shown for exposure to a severe lightning environment. The applicant must design for and verify that aircraft electrical/electronic systems are protected against the effects of lightning by:

- (1) Determining the lightning strike zones for the airplane;
- (2) Establishing the external lightning environment for the zones;
- (3) Establishing the internal environment;
- (4) Identifying all the electrical and electronic systems that are subject to the requirements of this section, and their locations on or within the airplane;
- (5) Establishing the susceptibility of the systems to the internal and external lightning environment;
- (6) Designing protection; and
- (7) Verifying that the protection is adequate.

[Doc. No. 25912, 59 FR 22116, Apr. 28, 1994]

§ 25.1317 High-intensity Radiated Fields (HIRF) Protection.

(a) Except as provided in paragraph (d) of this section, each electrical and electronic system that performs a function whose failure would prevent the continued safe flight and landing of the airplane must be designed and installed so that—

- (1) The function is not adversely affected during and after the time the airplane is exposed to HIRF environment I, as described in appendix L to this part;
- (2) The system automatically recovers normal operation of that function,

in a timely manner, after the airplane is exposed to HIRF environment I, as described in appendix L to this part, unless the system's recovery conflicts with other operational or functional requirements of the system; and

(3) The system is not adversely affected during and after the time the airplane is exposed to HIRF environment II, as described in appendix L to this part.

(b) Each electrical and electronic system that performs a function whose failure would significantly reduce the capability of the airplane or the ability of the flightcrew to respond to an adverse operating condition must be designed and installed so the system is not adversely affected when the equipment providing these functions is exposed to equipment HIRF test level 1 or 2, as described in appendix L to this part.

(c) Each electrical and electronic system that performs a function whose failure would reduce the capability of the airplane or the ability of the flightcrew to respond to an adverse operating condition must be designed and installed so the system is not adversely affected when the equipment providing the function is exposed to equipment HIRF test level 3, as described in appendix L to this part.

(d) Before December 1, 2012, an electrical or electronic system that performs a function whose failure would prevent the continued safe flight and landing of an airplane may be designed and installed without meeting the provisions of paragraph (a) provided—

- (1) The system has previously been shown to comply with special conditions for HIRF, prescribed under § 21.16, issued before December 1, 2007;
- (2) The HIRF immunity characteristics of the system have not changed since compliance with the special conditions was demonstrated; and
- (3) The data used to demonstrate compliance with the special conditions is provided.

[Doc. No. FAA-2006-23657, 72 FR 44025, Aug. 6, 2007]

INSTRUMENTS: INSTALLATION

§ 25.1321 Arrangement and visibility.

(a) Each flight, navigation, and powerplant instrument for use by any pilot must be plainly visible to him from his station with the minimum practicable deviation from his normal position and line of vision when he is looking forward along the flight path.

(b) The flight instruments required by § 25.1303 must be grouped on the instrument panel and centered as nearly as practicable about the vertical plane of the pilot's forward vision. In addition—

(1) The instrument that most effectively indicates attitude must be on the panel in the top center position;

(2) The instrument that most effectively indicates airspeed must be adjacent to and directly to the left of the instrument in the top center position;

(3) The instrument that most effectively indicates altitude must be adjacent to and directly to the right of the instrument in the top center position; and

(4) The instrument that most effectively indicates direction of flight must be adjacent to and directly below the instrument in the top center position.

(c) Required powerplant instruments must be closely grouped on the instrument panel. In addition—

(1) The location of identical powerplant instruments for the engines must prevent confusion as to which engine each instrument relates; and

(2) Powerplant instruments vital to the safe operation of the airplane must be plainly visible to the appropriate crewmembers.

(d) Instrument panel vibration may not damage or impair the accuracy of any instrument.

(e) If a visual indicator is provided to indicate malfunction of an instrument, it must be effective under all probable cockpit lighting conditions.

[Amdt. 25-23, 35 FR 5679, Apr. 8, 1970, as amended by Amdt. 25-41, 42 FR 36970, July 18, 1977]

§ 25.1322 Warning, caution, and advisory lights.

If warning, caution or advisory lights are installed in the cockpit, they must,

unless otherwise approved by the Administrator, be—

(a) Red, for warning lights (lights indicating a hazard which may require immediate corrective action);

(b) Amber, for caution lights (lights indicating the possible need for future corrective action);

(c) Green, for safe operation lights; and

(d) Any other color, including white, for lights not described in paragraphs (a) through (c) of this section, provided the color differs sufficiently from the colors prescribed in paragraphs (a) through (c) of this section to avoid possible confusion.

[Amdt. 25-38, 41 FR 55467, Dec. 20, 1976]

EFFECTIVE DATE NOTE: At 75 FR 67209, Nov. 2, 2010, § 25.1322 was revised, effective Jan. 3, 2011. For the convenience of the user, the revised text is set forth as follows:

§ 25.1322 Flightcrew alerting.

(a) Flightcrew alerts must:

(1) Provide the flightcrew with the information needed to:

(i) Identify non-normal operation or airplane system conditions, and

(ii) Determine the appropriate actions, if any.

(2) Be readily and easily detectable and intelligible by the flightcrew under all foreseeable operating conditions, including conditions where multiple alerts are provided.

(3) Be removed when the alerting condition no longer exists.

(b) Alerts must conform to the following prioritization hierarchy based on the urgency of flightcrew awareness and response.

(1) Warning: For conditions that require immediate flightcrew awareness and immediate flightcrew response.

(2) Caution: For conditions that require immediate flightcrew awareness and subsequent flightcrew response.

(3) Advisory: For conditions that require flightcrew awareness and may require subsequent flightcrew response.

(c) Warning and caution alerts must:

(1) Be prioritized within each category, when necessary.

(2) Provide timely attention-getting cues through at least two different senses by a combination of aural, visual, or tactile indications.

(3) Permit each occurrence of the attention-getting cues required by paragraph (c)(2) of this section to be acknowledged and suppressed, unless they are required to be continuous.

(d) The alert function must be designed to minimize the effects of false and nuisance alerts. In particular, it must be designed to: